



# Issue Paper: Traumatic Brain Injury and Suicidal Ideation in Deployed Navy Personnel

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**Issue Paper: Traumatic Brain Injury and Suicidal Ideation in Deployed Navy Personnel**

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**BLUF :** Among Navy personnel surveyed during their ground deployment to OIF/OEF theaters of operation between 2010 and 2012 ( $N = 3,710$ ), the odds of suicidal ideation were more than twice as high for service members with possible TBI exposure than for those with no TBI exposure ( $OR = 2.68$ ). Controlling for family concerns, PTSD symptoms, and depression symptoms, TBI was no longer a significant predictor of suicidal ideation, whereas the psychological variables were. Although these results may suggest that psychological variables play a bigger role than TBI in predicting suicidal ideation, this result may reflect more reliable measurement of psychological variables than TBI. Further research on this question is needed.

**BACKGROUND:** Due to the frequent use of improvised explosive devices against American service members, traumatic brain injury (TBI) has emerged as the signature injury among veterans of the conflicts in Iraq and Afghanistan (OIF/OEF). At the same time, rates of suicide among service members have increased dramatically.<sup>1</sup> This has led to questions about a possible link between TBI and suicidal behavior. To date, evidence on this issue has been limited, and findings have been mixed.<sup>2-5</sup> One factor that may help to explain these mixed results is that TBI often co-occurs with other risk factors for suicidal behavior such as relationship or family problems, posttraumatic stress disorder (PTSD), and other psychiatric disorders.<sup>6,7</sup> As a result, whether TBI appears to predict suicide risk may depend in part on what other predictors are included in the model.

**PURPOSE:** The purpose of the present study was to examine whether military personnel with possible TBI during deployment were at elevated increased risk of suicidal ideation while in theater. A secondary purpose was to examine whether TBI exposure is predictive of suicidal ideation after controlling for potential confounds, including demographic and military characteristics, prior deployment, family concerns, and symptoms of PTSD and depression.

**DATA SOURCE:** Since December 2006, Naval Health Research Center has conducted the Behavioral Health Needs Assessment Survey (BHNAS). The BHNAS is an anonymous survey administered to Navy expeditionary sailors during a “boots on the ground” deployment to Iraq or Afghanistan. The present analyses were based on 6 waves of data collection conducted between January 2010 and December 2012.

**SAMPLE:** In total, 3,710 service members completed the BHNAS survey during the 3-year study period. Characteristics of the sample are provided in Tables 1 and 2. As reflected in the table, sample size varies across variables due to missing data.

**Table 1. Demographic Characteristics**

Demographic characteristic	<i>n</i>	%
Sex		
Male	2,988	82
Female	638	18
Race/ethnicity		
White, non Hispanic	2,313	65
Black, non Hispanic	490	14
Hispanic	404	11
Asian	261	7
Other	114	3
Marital status		
Married	2,205	60
Never married	1,064	29
Divorced or widowed	383	11
Age, years		
19–22	257	7
23–30	1,241	34
31–40	1,274	35
41–50	724	20
51+	137	4

**Table 2. Military Characteristics**

Military characteristic	<i>n</i>	%
Component		
Active duty	2,626	71
Reserve	1,053	29
Previous deployment		
No	2,585	71
Yes	1,062	29
Pay grade		
E1–E3	147	4
E4–E6	1,934	53
E7–E9	418	11
O1–O3	502	14
O4+	660	18

**MEASURES:** The measures relevant to the present analyses assessed suicidal ideation, possible TBI, depression symptoms, PTSD symptoms, and family concerns.

Suicidal ideation was assessed by a single item from the Patient Health Questionnaire-9 depression scale.<sup>8</sup> This item has frequently been used in previous research to assess suicidal ideation.<sup>9,10</sup> The item asked how often in the past 4 weeks the respondent had “Thoughts that you would be better off dead or of hurting yourself in some way.” Responses were made on a 4-point scale (0 = *not at all*, 3 = *nearly every day*). For the present analyses, service members were dichotomously classified (any suicidal thoughts vs. no suicidal thoughts).

Possible TBI was assessed by 5 indicators. Sailors who responded positively to any of these items with reference to the current deployment were classified as having possible TBI.

- Being in a vehicle when it was damaged by a blast.
- Being within 50 meters of a blast explosion.
- Receiving a blow or jolt to the head.
- Being evaluated for TBI or concussion by a medical professional.
- Receiving a positive diagnosis for a TBI or concussion.

Depression symptoms were assessed by the 8 items of the PHQ-9 depression scale<sup>8</sup> (excluding the item that specifically referenced suicidal ideation, described above). Respondents rated how often they experienced each symptom in the past 4 weeks (0 = *not at all*, 3 = *nearly every day*); item responses were summed to create an index of depression severity.

PTSD symptoms were assessed by the 17-item PTSD Checklist–Civilian Version.<sup>11</sup> Respondents rated how much they had been bothered by each symptom in the past month (1 = *not at all*, 5 = *extremely*). Item responses were summed to compute an index of PTSD symptom severity.

Family concerns were assessed by 2 items that asked how much trouble or concern respondents had experienced during the current deployment due to “Being separated from family” and “Illness or problems back home.” Responses ranged from 1 (*very low*) to 5 (*very high*). Responses were averaged to create an index of family concerns.

## RESULTS

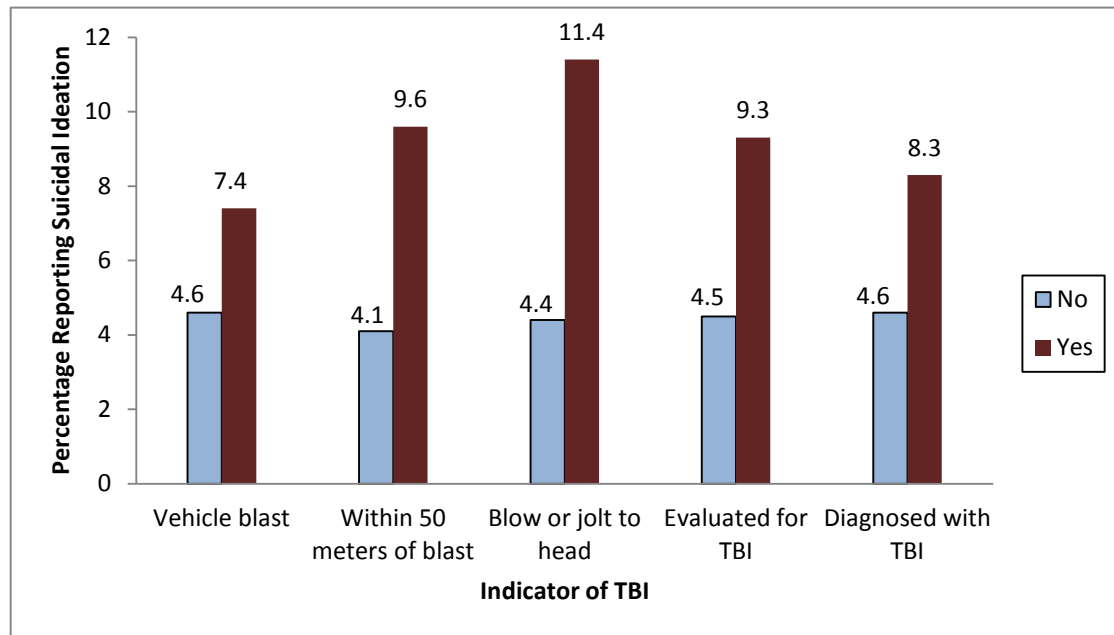
### 1. How common are TBI exposure and suicidal ideation in this sample?

Approximately 1 in 11 (8.9%) Sailors were classified as having possible TBI exposure during the current deployment, and nearly 1 in 20 (4.5%) reported suicidal ideation in the past 4 weeks.

### 2. Is TBI exposure associated with higher levels of suicidal ideation?

Suicidal ideation was significantly more common among personnel who reported possible TBI events during the current deployment (9.9%) than among personnel reporting no TBI exposure (4.0%;  $p < .001$ ). This pattern was evident on each individual item used to assess possible TBI exposure, as shown in the figure below. Even after controlling for demographic and military characteristics (sex, race/ethnicity, marital status, component, pay grade, and previous

deployment), the odds of experiencing suicidal ideation were more than twice as high for individuals with possible TBI than for those with no TBI exposures ( $OR = 2.68, p < .001$ ).



### 3. Are demographic or military characteristics associated with suicidal ideation?

Of the demographic and military characteristics considered, only pay grade was significantly related to suicidal ideation. Higher ranking personnel were significantly less likely to report suicidal thoughts than lower ranking personnel ( $p < .01$ ). Although bivariate analyses indicated that single Sailors were more likely than their married counterparts to report suicidal ideation, this association was no longer significant after controlling for other demographic and military characteristics. The likelihood of suicidal thoughts did not vary by deployment history, component, sex, or race/ethnicity ( $p > .1$ ).

### 4. Are PTSD symptoms, depression symptoms, or family concerns associated with suicidal ideation?

Simple correlations revealed that suicidal ideation was significantly ( $p < .001$ ) more likely among individuals with higher levels of PTSD symptoms ( $r = .36$ ), depression symptoms ( $r = .39$ ), and family concerns ( $r = .16$ ). These effects remained significant ( $p < .05$ ) when they were simultaneously considered as predictors of suicidal ideation after controlling for demographic and military characteristics as well as possible TBI exposure.

**5. Does possible TBI exposure remain a significant predictor of suicidal ideation after controlling for PTSD symptoms, depression symptoms, and family concerns?**

After controlling for PTSD symptoms, depression symptoms, and family concerns, possible TBI exposure was no longer a significant predictor of suicidal ideation ( $OR = 0.97, p > .9$ ).

**CONCLUSIONS:** In these data, personnel with possible TBI exposure during their current deployment were more than twice as likely as personnel with no TBI exposure to report suicidal ideation in the past 4 weeks ( $OR = 2.68$ ). This association remained significant after controlling for demographic and military characteristics. However, TBI was no longer a significant predictor of suicidal ideation after controlling for PTSD symptoms, depression symptoms, and family concerns. It would be premature to conclude that the apparent association between TBI and suicidal ideation is spurious. This study pitted a relatively crude dichotomous measure of possible TBI exposure against more precise validated measures of PTSD and depression. A fairer test of the relative predictive power of TBI and psychological symptoms would involve equally precise measures of each construct. Unfortunately, there is currently no clear “gold standard” for assessing TBI, even in controlled medical environments.<sup>6</sup> In addition, evidence suggests that clinical diagnoses of TBI, self-report assessments of TBI, and assessments of cellular evidence of injury or brain damage may each lead to different conclusions regarding the diagnosis.<sup>6</sup> Ultimately, a full assessment of the role of TBI in suicidal behavior must await the development of better measures of TBI.

**STRENGTHS AND LIMITATIONS:** The present results illuminate several factors that are associated with increased suicidal ideation in a large sample of personnel who were surveyed in theater during deployment to OIF/OEF. The fact that BHNAS data are collected in “real time,” from personnel who are currently in theater, is a significant strength. This dramatically reduces threats to validity due to biases in recall that are a concern in studies that rely on the retrospective reports of service members who have returned from deployment. In addition, although self-report measures are subject to potential response biases, this is much less problematic for anonymous surveys such as the BHNAS than for surveys that are not anonymous.<sup>12</sup> It is important to bear in mind that the data are cross-sectional, and therefore do not permit causal conclusions. Only experimental research or carefully designed longitudinal studies can help to clarify whether causal relationships exist.

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## REPORT DOCUMENTATION PAGE

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<b>13. SUPPLEMENTARY NOTES</b> This is a technical report only; it will not be submitted for journal publication.					
<b>14. ABSTRACT</b>  Increasing rates of traumatic brain injury (TBI) and suicidal behavior among service members are a growing concern. Previous research on TBI and suicidal ideation has been limited, and findings have been mixed. Because TBI often co-occurs with other risk factors for suicidal behaviors, findings that do not control for these other predictors may be misleading. The present study tested a model inclusive of other risk factors for suicidal behaviors, including demographic and military characteristics, prior deployment, family concerns, and symptoms of depression and posttraumatic stress disorder (PTSD). Results revealed that recent suicidal ideation was more common among personnel who reported possible TBI than among personnel reporting no TBI during the current deployment. This relationship remained significant after controlling for demographic and military characteristics. However, after controlling for depression symptoms, PTSD symptoms, and family concerns, the association between TBI and suicidal ideation was no longer significant. Despite these findings, it would be premature to conclude that the apparent association between TBI and suicidal ideation is spurious. The model tested in the present study pitted a crude dichotomous measure of TBI against more precise, validated measures of psychiatric symptoms. A full and fair assessment of the role of TBI in suicidal ideation and other suicidal behavior awaits the development of more precise and valid measures of TBI.					
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